

**Title: SCANNING DEVICE**

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**Field of Invention**

**[0001]** The invention relates to a scanner and, more particularly, to a scanner that is capable of compensating the boundary regions of the lamp.

**Background of the Invention**

**[0002]** A scanner scans pictures, texts, and photographs into graphic files.

**[0003]** FIG. 1A is a partially schematic diagram of a conventional scanner. As shown in FIG. 1A, a conventional scanner includes a lamp 101 and an object 103 to be scanned. The lamp 101 emits a light beam toward the object 103. Specifically, the intensity of the light beam received by the object 103 must reach a certain level so that the object (e.g. a picture or a text) can be precisely converted into a graphic file. However, the light beam from the areas at two sides of the lamp is not very strong due to the physical constraint of the lamp 101 itself; therefore, the designer of the scanner has to employ a light tube that its length is longer than the widest width of the object to be scanned.

**[0004]** Also, referring to FIG. 1B, a conventional scanner includes a lamp 101, an object to be scanned 103, and a reflector 105. The reflector 105 is located above the lamp 101. When the lamp 101 emits a light beam, the object 103 will receive a direct light beam from the lamp 101 as well as a reflected light beam from the reflector 105.

**[0005]** In addition, as shown in FIG. 1C, the reflector 105 is a parabolic surface, and the lamp 101 is placed on the focus of the reflector 105. When the reflector 105 reflects the light beam emitted by the lamp 101, according to the property of the light beam, the reflected light beam will be emitted downwardly in parallel toward the object 103 so that

the intensity of the light beam received by the object 103 can be intensified to increase the work performance of the scanner. However, the light beam at two sides of the light tube is insufficient due to the physical constraint of the lamp 101.

**[0006]** On the other hand, designing a slimmer and smaller apparatus has been a trend pursued by designers. However, the light beam in the boundary regions of the light tube hampers the space utilization of a scanner. For instance, in an A4 scanner, the length of its light tube is generally longer than the widest width of the object to be scanned in about 3 to 4 centimeters, which in turn makes it impossible for the dimension of the scanner to be diminished. Therefore, it is imperative to have a device that compensates the light intensity in the boundary regions of the lamp so as to reduce the dimension of the scanner.

#### **Summary of the Invention**

**[0007]** The main and first object of the invention is to provide a scanning device to solve the aforementioned problem. The scanning device includes a lamp, an object to be scanned, and a reflector. The reflector is placed between the lamp and the object, while the surface of the reflector facing the object contains a plurality of refractors so as to refract the light beam emitted by the lamp.

**[0008]** The second object of the invention is to provide a scanning device, which includes a lamp and an object to be scanned. The lamp is a light tube of variable thickness having two ends and a central part, the thickness at two ends is larger than that at the central part for refracting the light beam.

**[0009]** The third object of the invention is to provide a scanning device, which includes a lamp and an object to be scanned. The lamp is a light tube, and the surface of the light tube facing the object contains a plurality of refractors so as to refract the light beam emitted by the lamp.

**[0010]** The fourth object of the invention is to provide a scanning device, which includes a lamp, an object to be scanned, and a convex plate. The convex plate is disposed over the lamp for reflecting the light beam emitted by the lamp.

**[0011]** The fifth object of the invention is to provide a scanning device, which includes a lamp, an object to be scanned, and a reflector. The reflector is disposed over the lamp, and the surface of the reflector facing the lamp contains a plurality of reflection units to reflect the light beam emitted by the lamp back to the lamp.

#### **Brief Description of the Drawings**

**[0012]** FIG. 1A is a schematic view of a lamp of a conventional scanning device and an object to be scanned, which illustrates insufficient light in the boundary regions at two ends of the light tube;

**[0013]** FIG. 1B is a schematic view of a lamp of a conventional scanning device and an object to be scanned, which illustrates the light beam received by the object is from the direct light beam emitted by the light tube and from the reflected light beam emitted by the reflective light tube of the reflective panel;

**[0014]** FIG. 1C is a side view of a conventional lamp and a reflector, which illustrates the optical path of the light beam that is firstly emitted by the lamp and then reflected by the reflector;

**[0015]** FIG. 2 is a schematic view showing that a transparency is added in between the lamp of the scanning device and the object of the first embodiment, and the surface of the transparency facing the object contains a plurality of refractors for refracting a light beam;

**[0016]** FIG. 3 is a schematic view showing that the lamp of the scanning device of the second embodiment is a light tube of variable thickness, the thickness at two ends is larger than that at the central part;

**[0017]** FIG. 4 is a schematic view showing that the lamp of the scanning device in the third embodiment is a light tube, and the surface of the light tube facing the object contains a plurality of refractors for refracting light beams;

**[0018]** FIG. 5 is a schematic view showing that a convex plate is added in above the lamp of the scanning device of the fourth embodiment for reflecting the light beam; and

**[0019]** FIG. 6 is a schematic view showing that a reflector is added in above the lamp of the scanning device of the fifth embodiment and the surface of the reflector facing the light beam contains a plurality of reflection units for reflecting the light beam.

### **Detailed Description**

**[0020]** The invention provides a scanning device for scanning an object, which includes a lamp, an object to be scanned, and a device for changing the optical path of the lamp. The light intensity at the two ends of the object can be intensified through the change of optical path. The invention will be further illustrated by means of the following embodiments.

#### **The First Embodiment**

**[0021]** FIG. 2 is a schematic diagram showing the first embodiment of the invention. The invention is a scanning device, including a lamp 201, an object 203 to be scanned, and a transparency 205. The lamp 201 emits a light beam toward the object 203, and the transparency 205 is placed between the lamp 201 and the object 203. The transparency has a first surface and a second surface. The first surface facing the lamp receives the light beam and allows the light beam passing through. The second surface contains a plurality of refractors for refracting the light beam. Thus, the light intensity at two ends of the object can be intensified.

## The Second Embodiment

**[0022]** FIG. 3 is a schematic diagram showing the second embodiment of the invention. The invention is a scanning device, including a lamp 301 and an object 303 to be scanned. The lamp 301 is a light tube of variable thickness. The tube has two ends and a central part, the thickness at two ends is larger than that at the central part for refracting the light beam. Thus, the light intensity at two ends of the object can be intensified.

## The Third Embodiment

**[0023]** FIG. 4 is a schematic diagram showing the third embodiment of the invention. The invention is a scanning device, including a lamp 401 and an object 403 to be scanned. The lamp 401 is a light tube that emits a light beam toward the object 403, and the surface of the light tube facing the object 403 contains a plurality of refractors for refracting the light beam. Thus, the light intensity at two ends of the object can be intensified.

## The Fourth Embodiment

**[0024]** FIG. 5 is a schematic diagram showing the fourth embodiment of the invention. The invention is a scanning device, including a lamp 501, an object 503 to be scanned, and a convex plate 505. The lamp 501 emits a light beam toward the object 503. The convex plate is located above the lamp 501 to reflect the light beam emitted by the lamp 501. Thus, the light intensity at two ends of the object can be intensified.

## The Fifth Embodiment

**[0025]** FIG. 6 is a schematic diagram showing the fifth embodiment of the invention. The invention is a scanning device, including a lamp 601, an object 603 to be scanned, and a reflector 605. The lamp 601 emits a light beam toward the object 603, and the reflector 605 is located above the lamp 601. The specific feature of the invention is the surface of the reflector 605 facing the lamp 601 contains a plurality of reflection units to reflect light

beams emitted by the lamp 601. Thus, the light intensity at two ends of the object can be intensified.

**[0026]** The embodiments above are only intended to illustrate the invention; they do not, however, limit the invention to the specific embodiments. Accordingly, various modifications and changes may be made without departing from the spirit and scope of the invention as described in the appended claims.